"A low cost synthesis method for functionalised iron oxide nanoparticles for magnetic hyperthermia from readily available materials"

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Supporting Information

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1. TEM,EDX and HRTEM analysis for iron oxide nanomaterials:

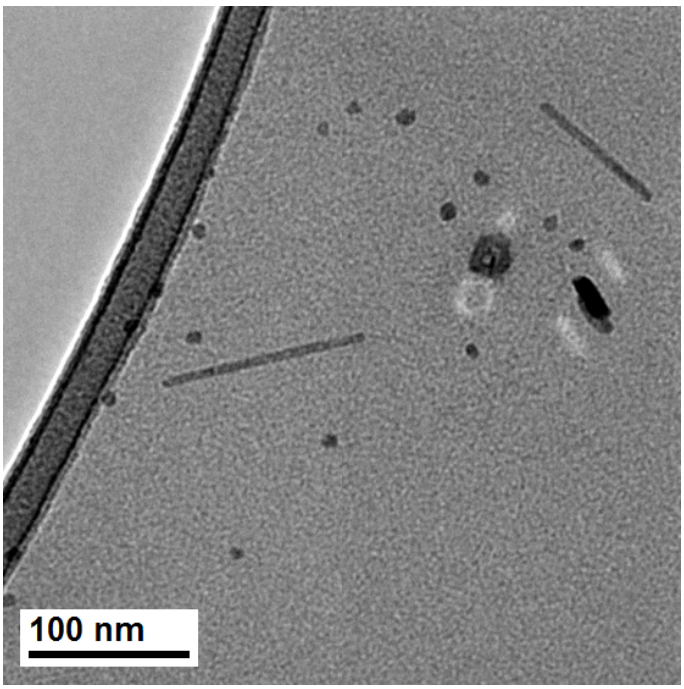

Figure S1.1 Transmission electron microscope (TEM) image of rhenanite nanorods synthesised with oleic acid (in a molar ratio of 1:1 iron palmitate to oleic acid) in shark liver oil.

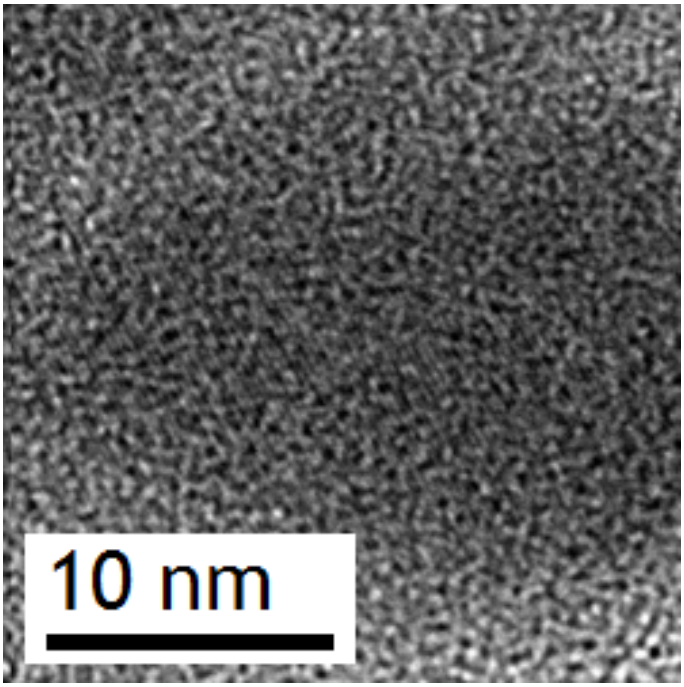

Figure S1.2 High resolution transmission electron microscope (HRTEM) image of Sample **(II)**, displaying <311> magnetite crystal planes.

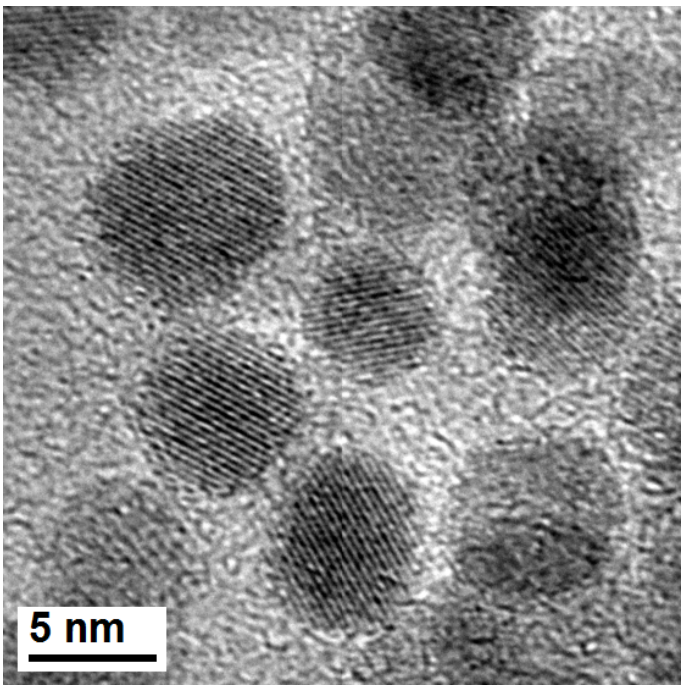

Figure S1.3 High resolution transmission electron microscope (HRTEM) image of magnetite nanoparticles synthesised according to a method adapted from Park *et al*.[1]

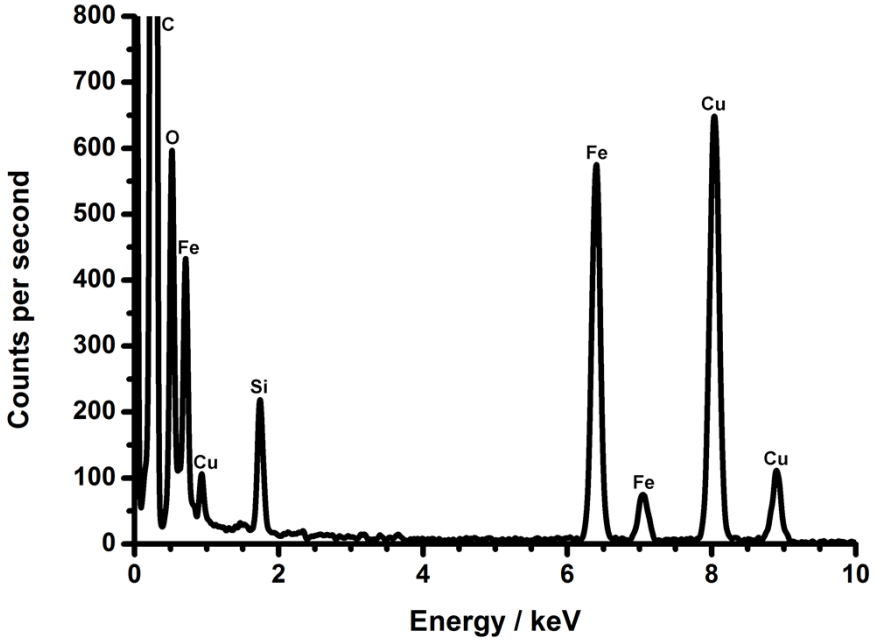

Figure S1.4 Energy dispersive X-ray spectrum of iron oxide nanoparticles synthesised according to Park *et al.*[1]

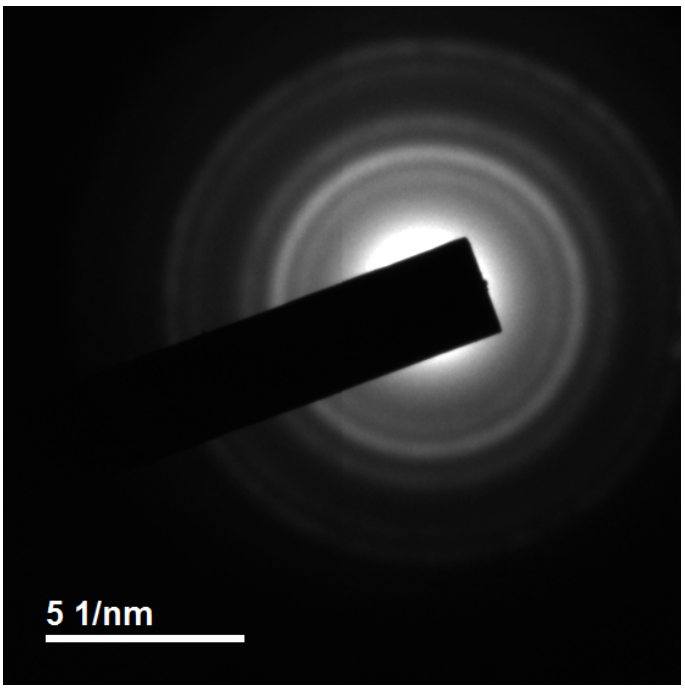

Figure S1.5 Selected area electron diffractogram (SAED) of iron oxide nanoparticles synthesised according to Park *et al*.[1]

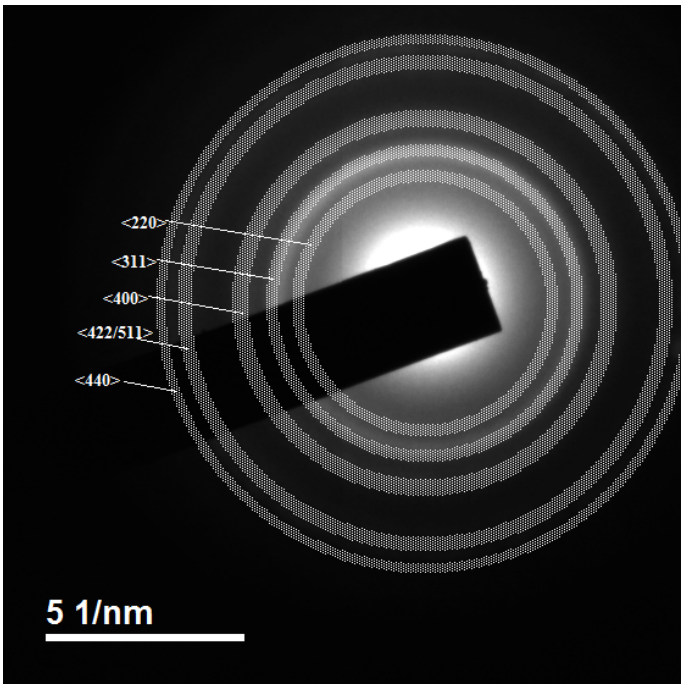

Figure S1.6 Labelled SAED of figure S2.5.

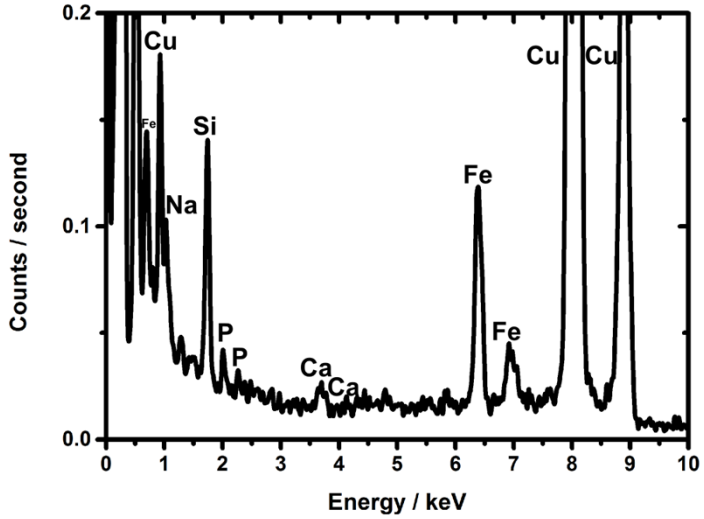

Figure S1.7 Zoomed EDX spectrum of iron oxide nanoparticles from the decomposition of iron palmitate in shark liver oil.

2. Differential Scanning Calorimetry:

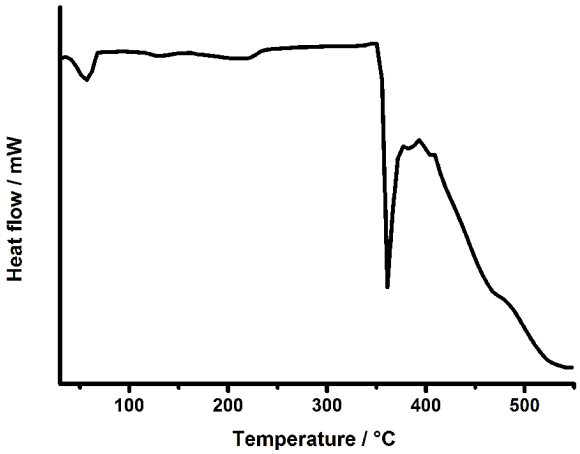

Figure S2.1 Differential Scanning Calorimetry (DSC) curve of iron-oleate.

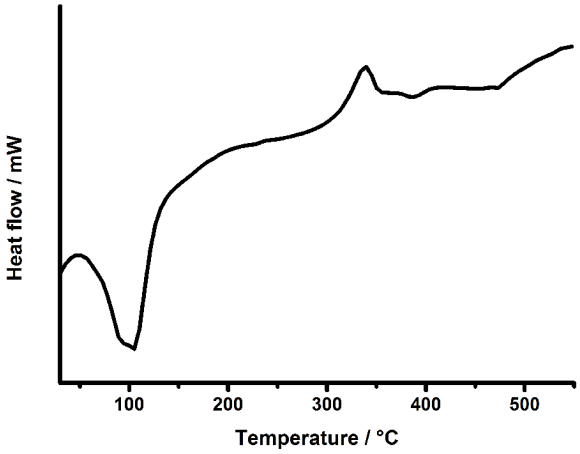

Figure S2.2 DSC curve of iron-palmitate.

3. ATR-FTIR spectra:

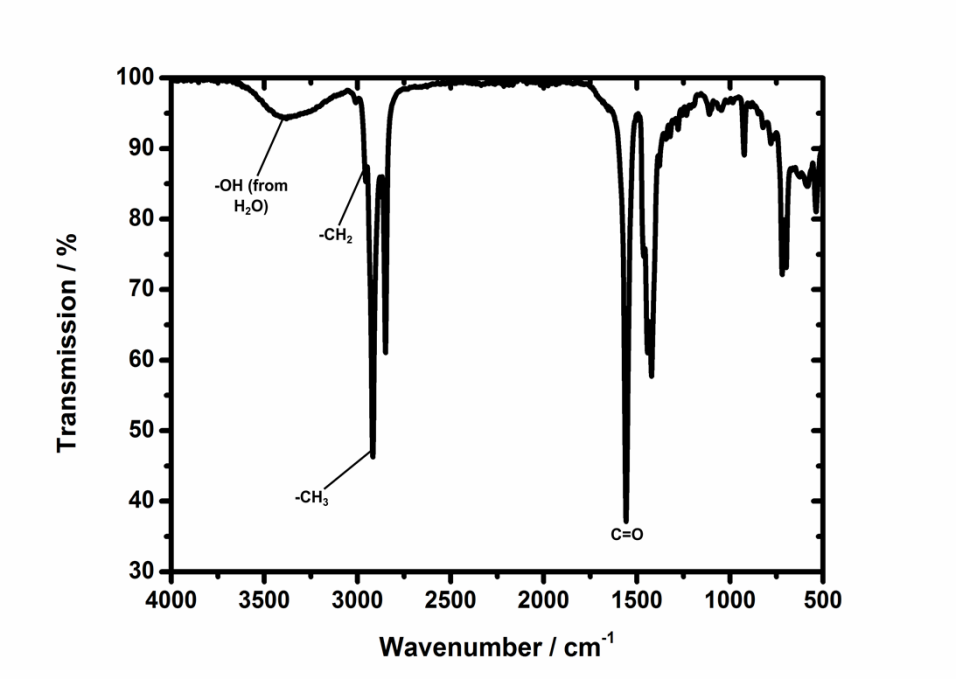

Figure S3.1 Fourier transform infrared spectrum of Sainsbury's Basics Soap, with the C=O stretch of sodium palmitate and -OH stretches from adsorbed water clearly visible.

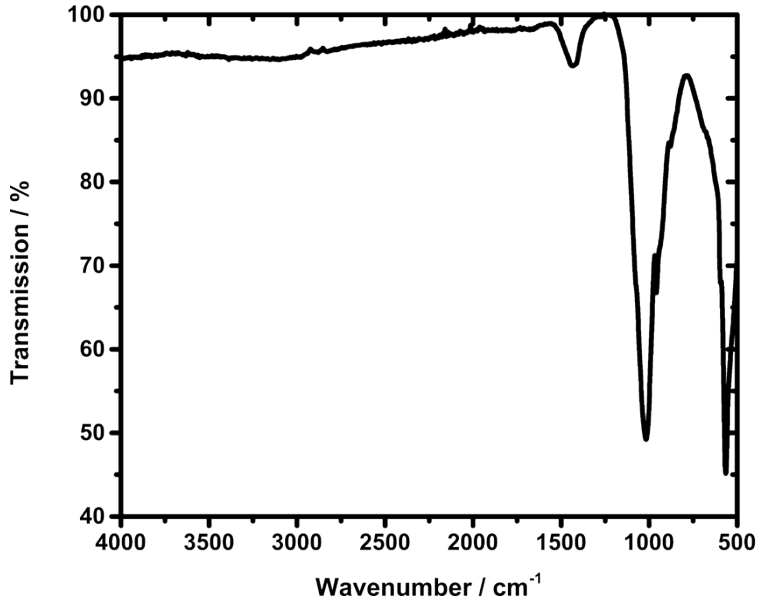

Figure S3.2 Fourier transform infrared spectrum of annealed (350 ºC in air) iron oxide nanoparticles synthesised *via* the decomposition of iron palmitate in shark liver oil, with the Fe-O stretch of the iron oxide visible at 565 cm^{-1}.

4. Table of costs

Reagent	Vendor	Price per gram (£ GBP)	High-street reagent	Vendor	Price per gram (£ GBP)
Iron(III) chloride hexahydrate (ACS reagent grade)	VWR International Ltd.	0.08*	Iron tablets	Boots Ltd.	0.12
Sodium oleate (≥82% fatty acid content)	Sigma-Aldrich	0.03*	"Basics soap"	J. Sainsbury Ltd.	0.0013
Oleic acid (techn. grade 90%)	Sigma-Aldrich	0.03*	Olive oil	J. Sainsbury Ltd.	0.0038
1-octadecene (techn. grade 90%)	Sigma-Aldrich	0.54*	Shark Liver oil	Shark Liver oil UK Ltd.	0.23

*The prices listed above do not include delivery, VAT and other associated costs.

For the synthesis of 1 g of nanoparticles exclusive of ligands and based on iron content of Fe_2O_3, the cost of the iron oleate and iron palmitate syntheses was £18.66* and £15.81 respectively.

5. Mössbauer analysis of iron palmitate decomposed in 1-octadecene

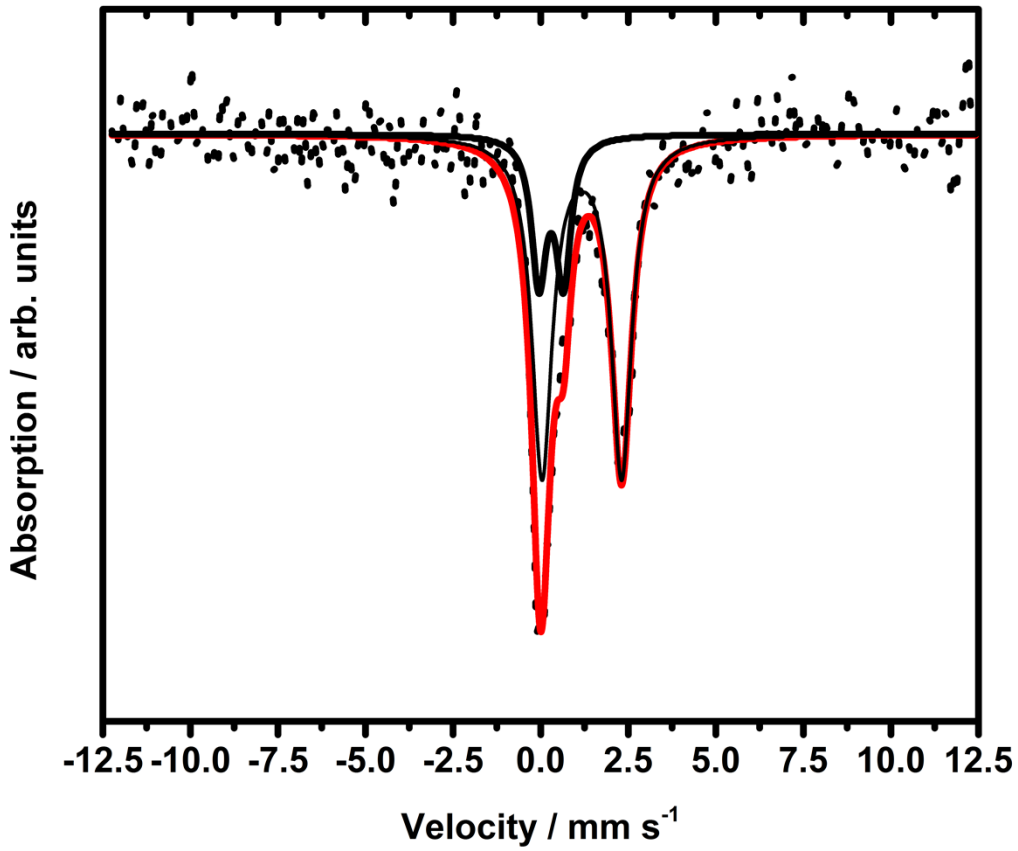

Figure S5 ^{57}Fe Mössbauer spectra of: iron oxide nanoparticles from iron palmitate decomposed in 1-octadecene (Sample **II**). The red trace represents the fit with the thick black line the Fe^{3+} doublet component and the thin black line the Fe^{2+} doublet component.

6. XRD patterns and references

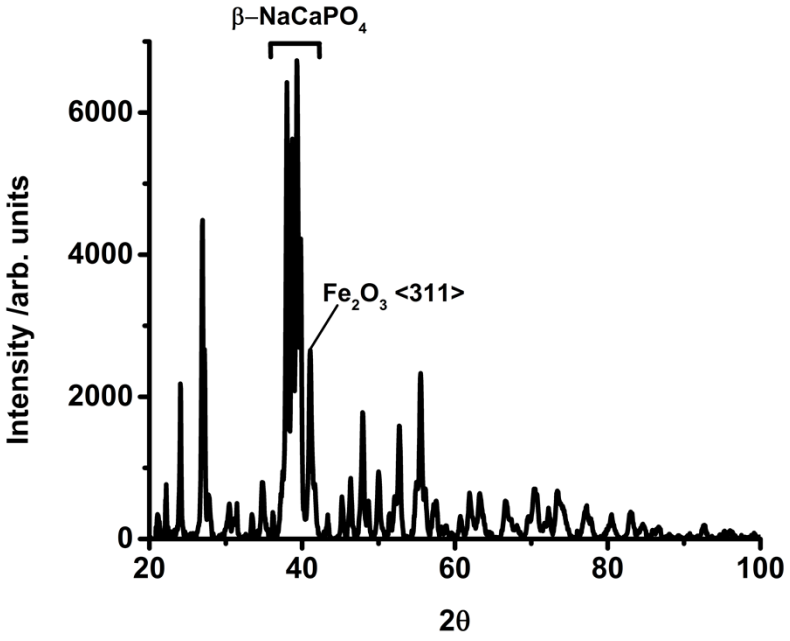

Figure S6.1 XRD pattern of annealed iron oxide nanoparticles prepared from the decomposition of iron palmitate in shark liver oil (Sample **(III)**). The <611>, <020> and <031>peaks of Rhenanite (β-$NaCaPO_4$) are visible between 38 and 42° (2θ).

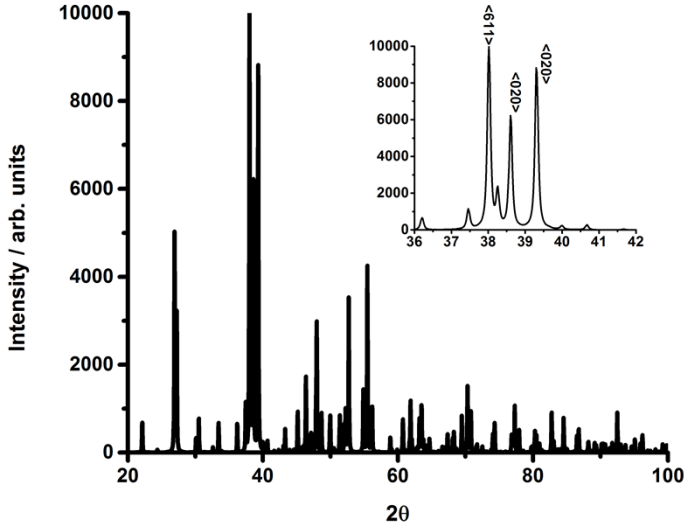

Figure S6.2 Standard XRD pattern of β-$NaCaPO_4$ (rhenanite).[2]

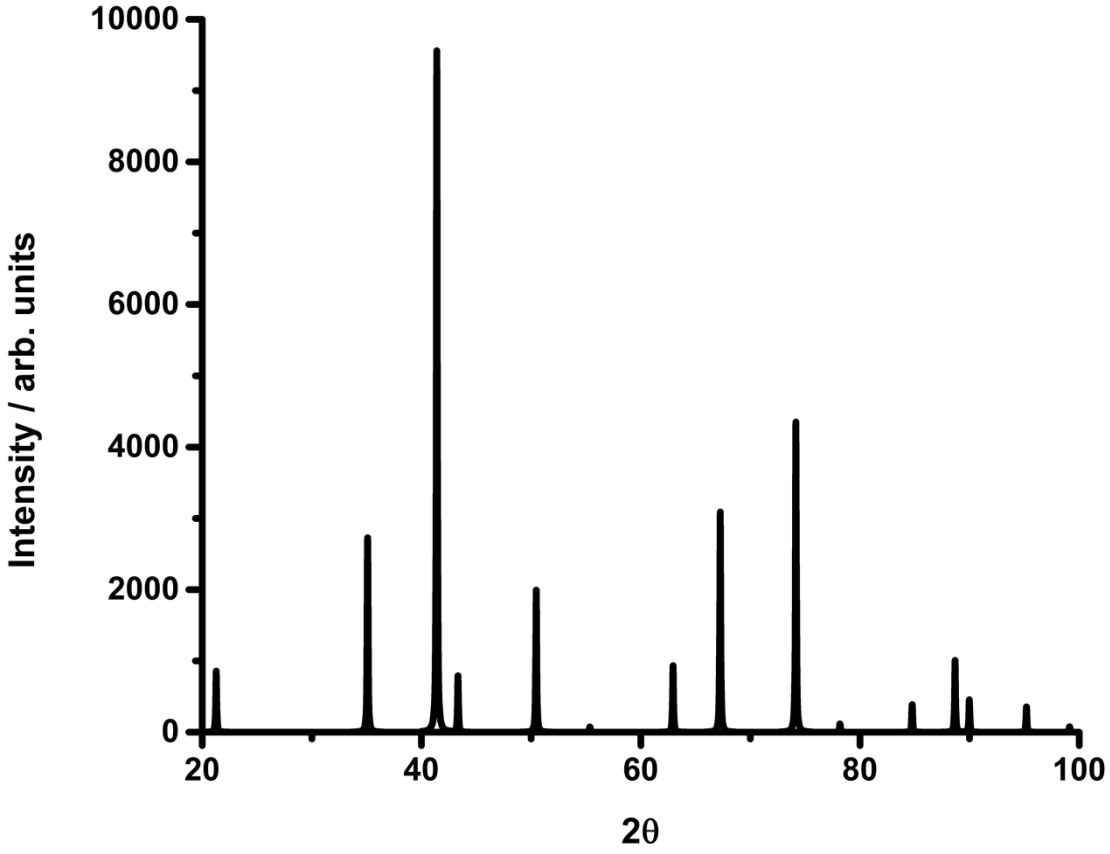

Figure S6.2 Standard XRD pattern of Fe_3O_4 (magnetite).[3]

7. References

1. J. Park, K. An, Y. Hwang, J.-G. Park, H.-J. Noh, J.-Y. Kim, J.-H. Park, N.-M. Hwang, and T. Hyeon, *Nat. Mater.*, 2004, **3**, 891–895.
2. ICSD no. 35629.
3. ICSD no. 64829.